

3-2. Trip to the Galapagos Islands

Hyeongseop and Minseok are leaving for the Galapagos Islands again, because they didn't manage to see the Finch bird on their last trip. This time, they are going to travel by only taking ferries.

In the Galapagos Islands, there are N islands numbered 0 through $N - 1$, M ferries numbered 0 through $M - 1$, and K types of finches numbered 0 through $K - 1$.

For every i ($0 \leq i \leq N - 1$), the only type of all finches who live in island i is $F[i]$. For every j ($0 \leq j \leq M - 1$), ferry j travels back and forth between island $S[j]$ and island $E[j]$. It is possible to visit all islands by taking some ferries consecutively. Also, if we visit all the islands, we can see all types of finches.

This year, the organizers decided not to operate some (possibly none) of the least 'important' ferries if the weather is terrible due to extreme weather. Ferry j_1 is more important than ferry j_2 if and only if $j_1 > j_2$.

Hyeongseop wants to see finch type A and Minseok wants to see finch type B . Hyeongseop will start his trip on one of the island(s) with finch type A and will visit all islands reachable by only taking ferries. Minseok will start his trip on one of the island(s) with finch type B and will visit all islands reachable by only taking ferries.

Hyeongseop and Minseok want to meet at an island and finish both of their trips there. If many ferries are not operating, they won't be able to be in the same island.

Write a program that computes the least x , where Hyeongseop and Minseok cannot meet on the same island wherever they start to travel when the least important x ferries are not operating.

Implementation details

You should implement the following functions.

```
void Init(int K, int[] F, int[] S, int[] E)
```

- K : number of types of finches
- F : an array of length N . For every i ($0 \leq i \leq N - 1$), only finch type $F[i]$ lives in island i .
- S , E : arrays of length M : For every j ($0 \leq j \leq M - 1$), ferry j travels back and

forth between island $S[j]$ and island $E[j]$.

- This procedure is called exactly once, and before any call to `Separate` (per test case).

```
int Separate(int A, int B)
```

- A : Hyeongseop wants to see finch type A .
- B : Minseok wants to see finch type B .
- This function should return the minimum possible x , where Hyeongseop and Minseok cannot meet on the same island wherever they start to travel when the least important x ferries are not operating.
 - Note that Hyeongseop has to start from an island with finch type A , and Minseok has to start from an island with finch type B .
- This function is called Q times after the function `Init` is called.

Constraints

- $1 \leq N \leq 100\,000$
- $1 \leq M \leq 300\,000$
- $1 \leq K \leq N$
- $1 \leq Q \leq 50\,000$
- For all $0 \leq i \leq N - 1$, $0 \leq F[i] \leq K - 1$
- For all $0 \leq j \leq M - 1$:
 - $0 \leq S[j], E[j] \leq N - 1$
 - $S[j] \neq E[j]$
- For every $0 \leq f \leq K - 1$, there exists some i ($0 \leq i \leq N - 1$) where $F[i] = f$ holds.
- For every $0 \leq i_1 < i_2 \leq N - 1$, at most one ferry travels back and forth between island i_1 and island i_2 .
- It is possible to move from an island to any other island by taking some ferries consecutively. (In short, Islands are connected by ferries)
- For every function call of `Separate`:
 - $0 \leq A, B \leq K - 1$
 - $A \neq B$

Subtasks

1. (31 points) $K = N$.
2. (39 points) $K \leq 1\,000$.
3. (30 points) No additional constraints.

Example

Consider the following call:

```
Init(3, [0, 1, 2, 0, 1], [0, 2, 2, 4, 1, 0], [1, 3, 4, 3, 2, 4])
Separate(0, 1)
Separate(1, 2)
Separate(0, 2)
```

The answers for each Separate calls are 6, 5, and 3 respectively.

Sample grader

You can download the sample grader package on the same page you downloaded the problem statement. (scroll down if you don't see the attachment)

If you use IDEs like Visual Studio, Eclipse or Code::Blocks, then import `island.cpp`, `island.h` and `grader.cpp` into one project and you will be able to compile all these files at once.

If you want to compile by yourself, refer to the compilation commands in the statement page.

You should submit only `island.cpp`.

Input format

- line 1: $N M K Q$
- line 2: $F[0] F[1] \dots F[N - 1]$
- line $3 + j$ ($0 \leq j \leq M - 1$): $S[j] E[j]$
- line $3 + M + k$ ($0 \leq k \leq Q - 1$): $A[k] B[k]$

Here, $A[k]$ and $B[k]$ are parameters for the call of Separate for the request k .

Output format

- line $1 + k$ ($0 \leq k \leq Q - 1$): the return value of Separate for the request k .